S.3 Proposed Action and No-Action Alternative

S.3.1 PROPOSED ACTION

Under the Proposed Action, DOE would construct, operate and monitor, and eventually close a geologic repository for the disposal of 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste at Yucca Mountain. The Proposed Action would include the transportation of spent nuclear fuel and high-level radioactive waste from commercial and DOE sites to the Yucca Mountain site.

DEFINITION OF METRIC TONS OF HEAVY METAL

Quantities of spent nuclear fuel are traditionally expressed in terms of *metric tons of heavy metal* (typically uranium), without the inclusion of other materials such as cladding (the tubes containing the fuel) and structural materials. A metric ton is 1,000 kilograms (1.1 tons or 2,200 pounds). Uranium and other metals in spent nuclear fuel (such as thorium and plutonium) are called *heavy metals* because they are extremely dense; that is, they have high weights per unit volume. One metric ton of heavy metal disposed of as spent nuclear fuel would fill a space approximately the size of a typical household refrigerator.

DOE would dispose of spent nuclear fuel and high-level radioactive waste in the repository using the natural geologic features of the mountain and engineered barriers as a total system to help ensure the long-term isolation of the materials from the accessible environment. DOE would build the repository inside Yucca Mountain, at least 200 meters (660 feet) below the surface and at least 160 meters (530 feet) above the present-day water table. Figure S-3 shows the location of the proposed repository at Yucca Mountain.

In addition, the Proposed Action would include the use of active institutional controls (controlled access, inspection, and maintenance, etc.) through the end of the closure period, and the use of passive institutional controls (markers, engineered barriers, etc.) after the completion of closure. The purpose of the passive institutional controls would be to prevent inadvertent intrusion by and exposures to members of the public.

S.3.1.1 Repository and Waste Package Design

The repository would be a large underground excavation with a number of interconnecting tunnels (called drifts) that DOE would use for waste emplacement. Figure S-4 shows the proposed repository concept.

PREFERRED ALTERNATIVE

DOE's preferred alternative is to proceed with the Proposed Action to construct, operate and monitor, and eventually close a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain.

DOE has also identified a preferred mode (the mostly rail scenario) of transporting spent nuclear fuel and high-level radioactive waste to the proposed repository. The smaller number of shipments required to transport 70,000 MTHM of spent nuclear fuel and high-level radioactive waste by the mostly rail scenario, coupled with the correspondingly reduced environmental impacts, form the basis for DOE's preference of the mostly rail scenario, both nationally and in Nevada.

The Draft EIS evaluated the preliminary design concept described in the 1998 *Viability Assessment of a Repository at Yucca Mountain.* DOE recognized when it published the Draft EIS that plans for a repository would continue to evolve during any development of a final repository design and as a result of any licensing review of the repository by the Nuclear Regulatory Commission. Later, DOE

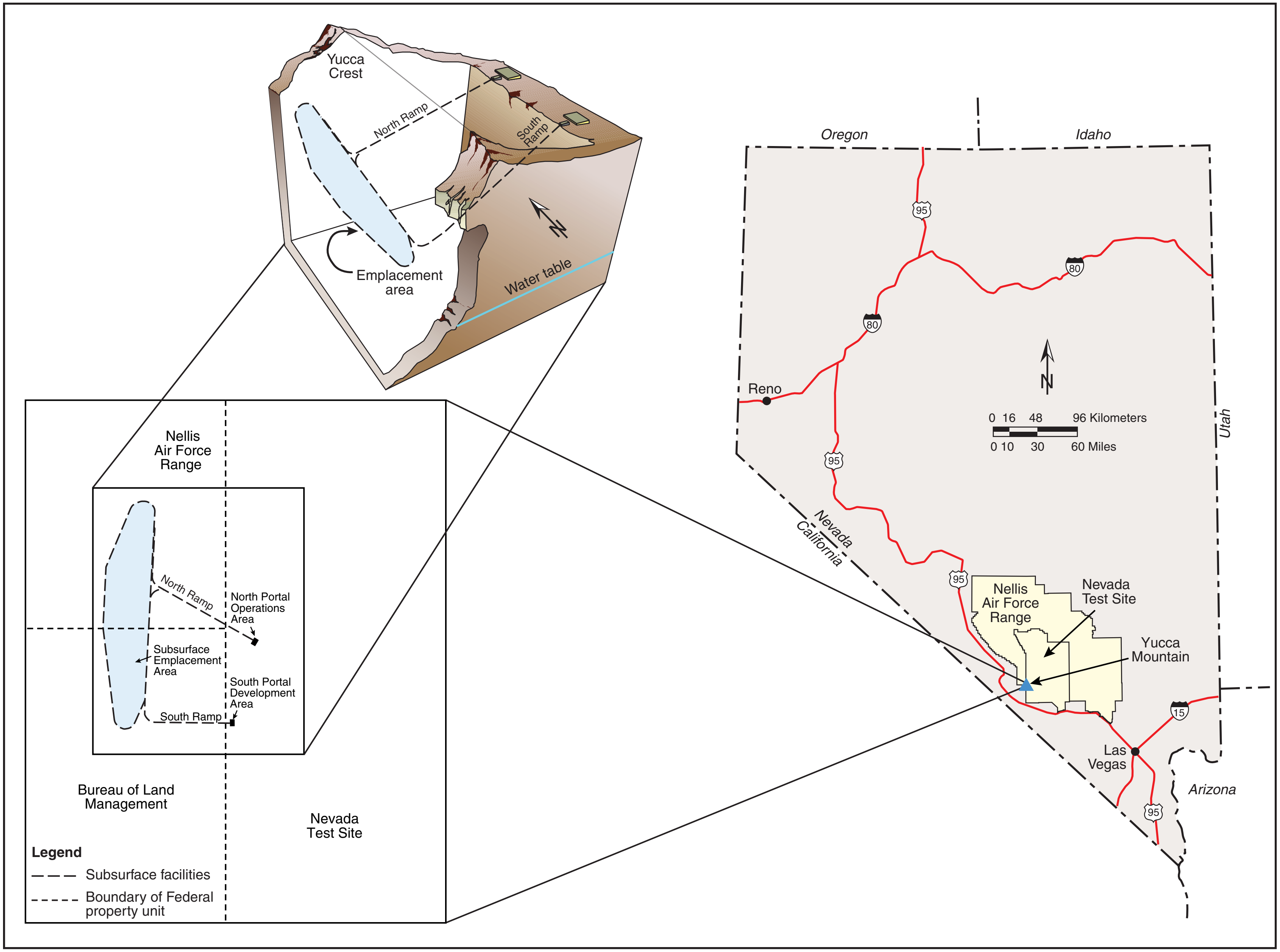


Figure S-3. Location of the proposed repository at Yucca Mountain.

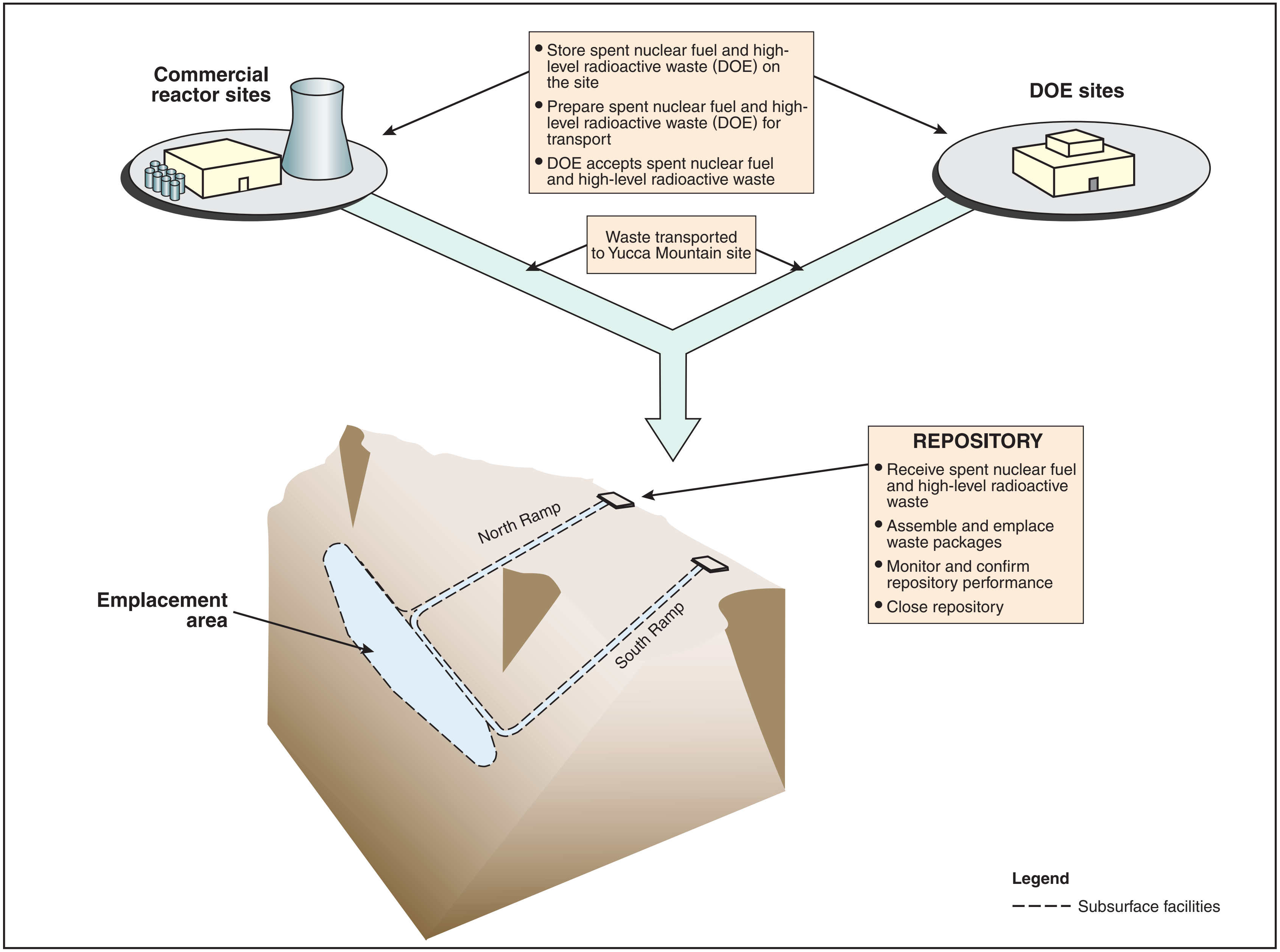


Figure S-4. Spent nuclear fuel and high-level radioactive waste handling, transportation, and disposal.

issued the Supplement to the Draft EIS that evaluated the repository design described in the *Yucca Mountain Science and Engineering Report: Technical Information Supporting Site Recommendation Consideration,* which it issued in May 2001. The flexible design analyzed in the Supplement includes an improved understanding of the interactions of potential repository features with the natural environment, the addition of design features for enhanced waste containment and isolation, and evolving regulatory requirements. Rather than analyzing the three thermal load scenarios (high, intermediate, and low thermal loads) as in the Draft EIS, the Final EIS analyzes a range of operating modes (higher- to lower-temperature) for the flexible design. Because (1) thermal load is no longer the descriptive parameter for specifying thermal management scenarios for the proposed repository, and (2) an effort was made in the Final EIS to avoid confusion and to clarify the impacts of the Proposed Action, DOE has not carried the earlier thermal load scenarios through to the Final EIS. (A comparison between the thermal load scenarios and the repository operating modes for the flexible design is provided in the Supplement to the Draft EIS.)

FLEXIBLE DESIGN

The flexible design includes the ability to operate the proposed repository in a range of operating modes that are characterized by higher and lower temperatures and associated humidity conditions. *Higher-temperature* means that at least a portion of the emplacement drift rock wall would have a maximum temperature above the boiling point of water at the elevation of the repository. The ranges analyzed for the *lower-temperature* operating mode include conditions under which the drift rock wall temperatures would be below the boiling point of water, and under which the surface temperature of the waste package would not exceed 85°C (185°F).

Modifications from the repository design introduced in the Draft EIS and analyzed in the Supplement to the Draft EIS include:

- The ability to blend hotter and cooler commercial spent nuclear fuel assemblies (the assemblies produce most of the heat generated by waste materials in a geologic repository) to control the heat generation of waste packages
- The flexibility to include a facility on the surface for aging (that is, cooling) of hotter commercial spent nuclear fuel to control the heat of waste packages
- Increased ventilation (forced and natural) to enable a cooler repository
- Increased spacing between emplacement drifts to allow a moisture pathway between drifts
- The operational flexibility to vary the spacing between the waste packages in a drift to manage the heat load
- Modified waste packages and the addition of titanium drip shields to improve overall performance and divert moisture

The purpose of the flexible design is to improve the long-term performance of the proposed repository, and reduce associated uncertainties.

DOE would receive materials at the repository in one of three configurations: uncanistered fuel (spent nuclear fuel placed directly in a shipping cask), dual-purpose canisters (containers designed to store and transport commercial spent nuclear fuel), or disposable canisters (canisters for spent nuclear fuel or high-level radioactive waste with multiple specialized overpacks to enable their storage, transportation, and emplacement in a repository). All DOE materials (spent nuclear fuel and high-level radioactive waste) would be received in disposable canisters. Commercial spent nuclear fuel would be received in any of the three packaging configurations. DOE cannot predict the particular combination of uncanistered fuel, dual-purpose canisters, or disposable canisters it would receive at a repository because the managers of the commercial sites would determine the canister type, if any, they will use. For that reason, in the Draft EIS the Department analyzed two fuel packaging scenarios [mostly uncanistered and mostly canistered (including dual-purpose canisters and disposable canisters)] that cover the possible range of repository and transportation impacts to human health and the environment. DOE's analysis shows that the mostly uncanistered fuel packaging scenario would result in the highest short-term impacts, with the exception of (1) the empty dual-purpose canisters that some commercial sites could use that would require disposal or recycling, and (2) some attributes of offsite manufacturing of disposable canisters. To simplify the presentation in this Final EIS, the impacts throughout this document include those associated with the mostly uncanistered fuel packaging scenario, plus the impacts of the waste management and offsite manufacturing impacts, which are also included to represent potential impacts associated with the canistered scenario. This approach ensures that the impacts presented in this Final EIS would bound the impacts of any packaging scenario ultimately selected.

DEFINITIONS OF PACKAGING TERMS

Shipping cask: A vessel that meets applicable regulatory requirements for shipping spent nuclear fuel or high-level radioactive waste.

Dual-purpose canister: A metal vessel suitable for storing (in a storage facility) and shipping (in a shipping cask) commercial spent nuclear fuel assemblies. At the repository, dual-purpose canisters would be removed from the shipping cask and opened. The spent nuclear fuel assemblies would be removed from the canister and placed in a disposal container or in the fuel pool to accommodate blending. The opened canister would be recycled or disposed of offsite as low-level radioactive waste.

Disposable canister: A metal vessel for commercial or DOE spent nuclear fuel assemblies or solidified high-level radioactive waste suitable for storage, shipping, and disposal. At the repository, the disposable canister would be removed from the shipping cask and placed directly in a disposal container. The disposable canister is sometimes referred to as a multi-purpose canister in discussions of repository design.

Uncanistered spent nuclear fuel: Commercial spent nuclear fuel placed directly into shipping casks. At the repository, spent nuclear fuel assemblies would be removed from the shipping cask and placed in a disposal container or in the fuel pool to accommodate blending.

Disposal container: A container for spent nuclear fuel and high-level radioactive waste consisting of the barrier materials and internal components. The filled, sealed, and tested disposal container is referred to as the *waste package*, which would be emplaced in the repository.

Waste package: The filled, sealed, and tested disposal container that would be emplaced in the repository.

Material received at the repository would be unloaded from the shipping casks and placed in disposal containers called *waste packages*. To control the heat generation of the waste packages, the flexible design includes thermal blending of commercial spent nuclear fuel assemblies. Remote-controlled transporters would place the waste packages in emplacement drifts.

DOE considered waste packages containing two layers—a corrosion-resistant Alloy-22 shell on the outside and a stainless-steel inner shell to provide structural support. The highly corrosion-resistant outer material of the waste package would protect the underlying structural material from corrosive degradation, while the extremely strong internal structural material would support the thinner corrosion-resistant material. A drip shield of titanium (also extremely corrosion-resistant) with a nominal thickness of 1.5 centimeters (0.6 inch) would be placed over the waste packages during the closure phase. With the titanium drip shield and the Alloy-22 outer cylinder, there would be two different corrosion barriers protecting the waste from contact with water. Further, the use of two distinctly different corrosion-resistant materials would reduce the probability that a single mechanism could cause failure in both materials. The waste packages, together with the titanium drip shields, would be the primary part of an engineered barrier system in the repository. This system would, in combination with the natural features of this site, help slow the release of radioactive material to the accessible environment for long periods.

NATURAL AND ENGINEERED FEATURES

Water is the primary means by which radionuclides disposed of at Yucca Mountain could reach the accessible environment. The natural features of the very dry climate, large distance to the water table, and geology of the site would act to limit the amount of water that entered the repository. The engineered features, including drip shields and waste packages made from corrosion-resistant material, would deter releases of radioactive material, even in the presence of any water that reached the emplacement area.

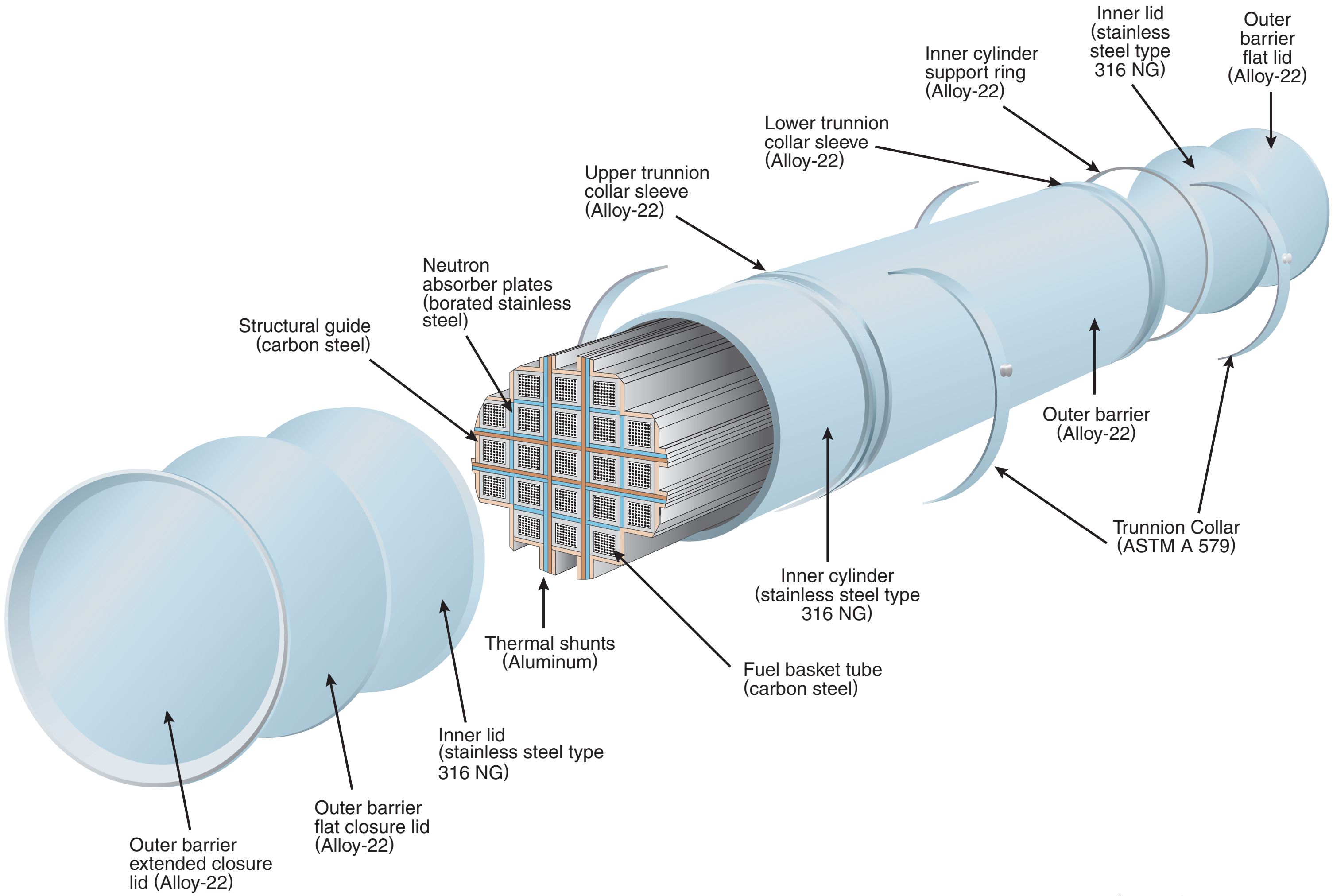
Under the Proposed Action, DOE would emplace approximately 11,000 to 17,000 waste packages containing no more than 70,000 MTHM of spent nuclear fuel and high-level radioactive waste in the repository. Of that amount, 63,000 MTHM would be spent nuclear fuel assemblies that would be shipped from commercial sites to the repository. The remaining 7,000 MTHM would consist of about 2,333 MTHM of DOE spent nuclear fuel and the equivalent of 4,667 MTHM of high-level radioactive waste, currently estimated to be approximately 8,315 canisters, that DOE would ship to the repository from DOE sites. The inventory includes surplus weapons-usable plutonium. At present, DOE expects two-thirds of the plutonium would be converted into mixed-oxide fuel, which is included as part of the commercial spent nuclear fuel inventory. DOE expects the remaining third of the plutonium to be immobilized and included in the high-level radioactive waste inventory.

Figure S-5 shows potential waste package designs for commercial spent nuclear fuel. Figure S-6 shows waste packages in an emplacement drift.

S.3.1.2 Preconstruction Testing and Performance Confirmation, Construction, Operation and Monitoring, and Closure

DOE would construct and operate surface facilities at the repository site to receive, prepare, and package spent nuclear fuel and high-level radioactive waste for emplacement in underground drifts. The surface and subsurface facilities developed for site characterization activities at Yucca Mountain would be incorporated into the repository design to the extent practicable. Figures S-7 and S-8 show conceptual designs of the surface and subsurface facilities, respectively. Figure S-9 shows the sequence for repository development at Yucca Mountain.

Preconstruction Testing and Performance Confirmation. The preconstruction Testing and Performance Confirmation Program would continue many of the same types of activities performed during site characterization and would include tests, experiments, and analyses that DOE would conduct to evaluate the long-term performance of the repository. Before the start of repository construction, this program would assume responsibility for activities now being performed as part of site characterization. Those activities would continue until closure of the repository.



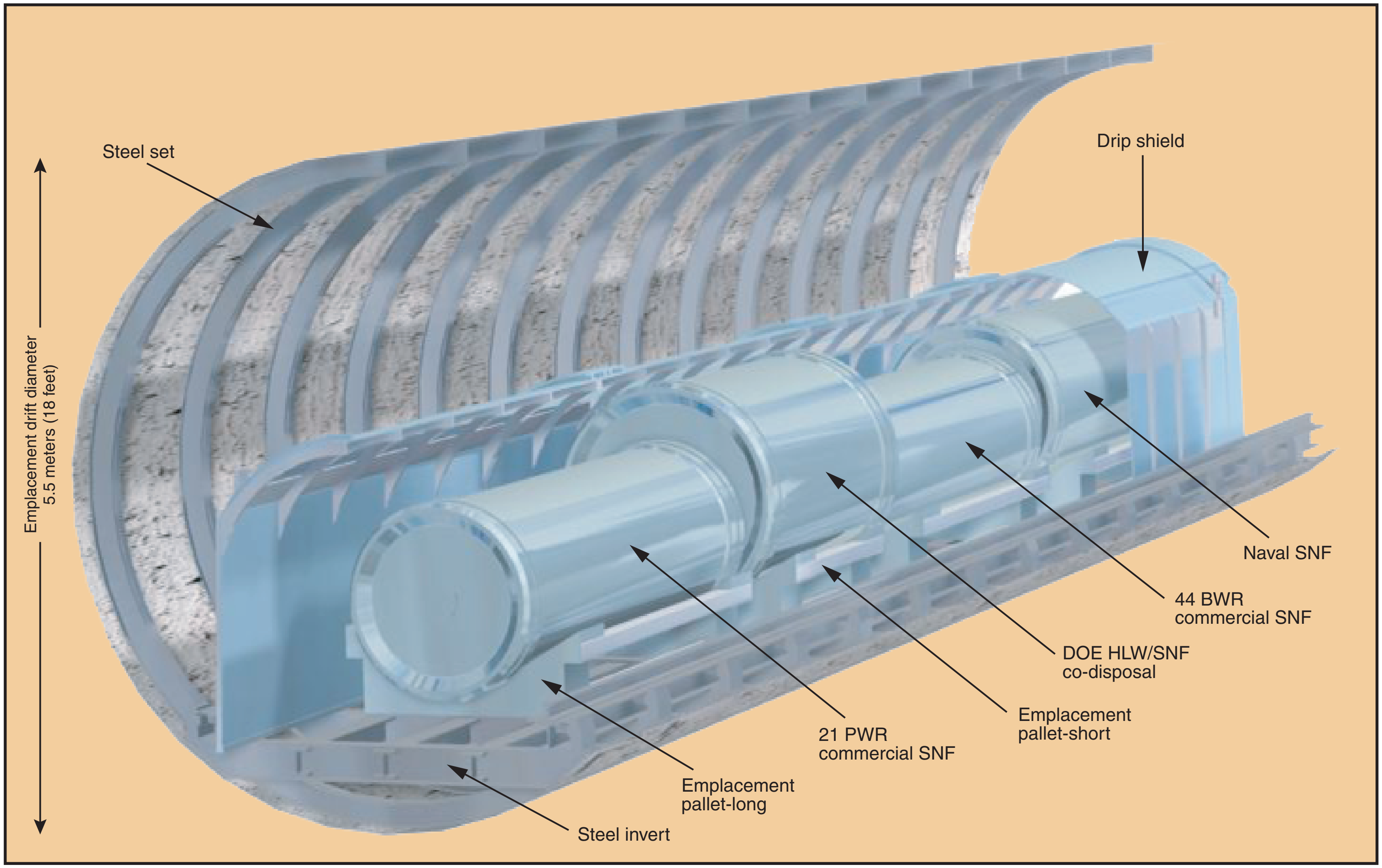
Legend

ASTM	American Society for Testing and Materials
NG	Nuclear grade stainless steel

Notes: Glossary contains definitions of terms.

Drawing not to scale.

Figure S-5. Waste package for commercial spent nuclear fuel (pressurized-water reactor waste package).



Drawing not to scale.

Legend

BWR	Boiling-water reactor
DOE	U.S. Department of Energy
HLW	High-level radioactive waste
PWR	Pressurized-water reactor
SNF	Spent nuclear fuel

Figure S-6. Typical section of emplacement drift with waste packages and drip shields in place.

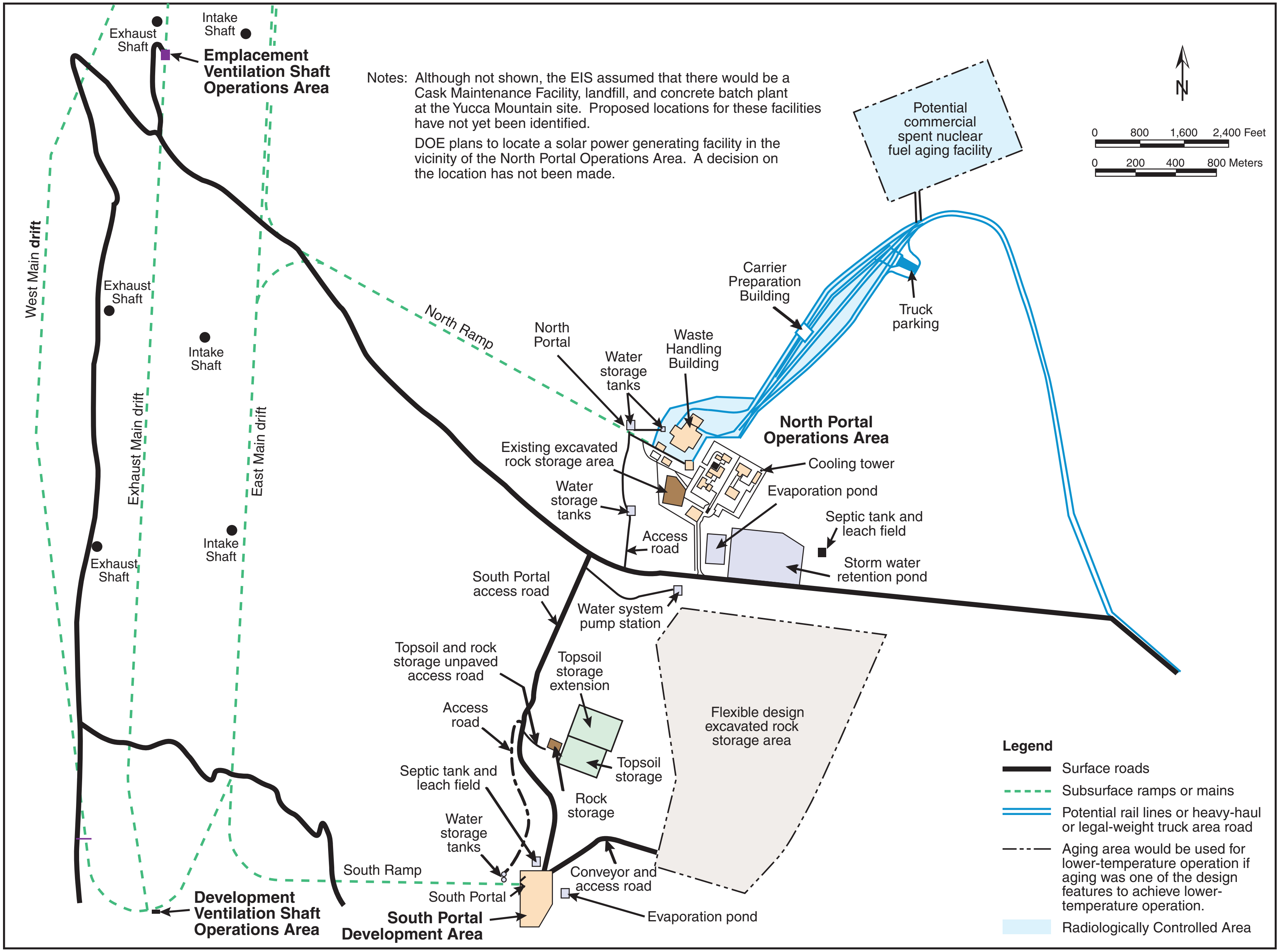
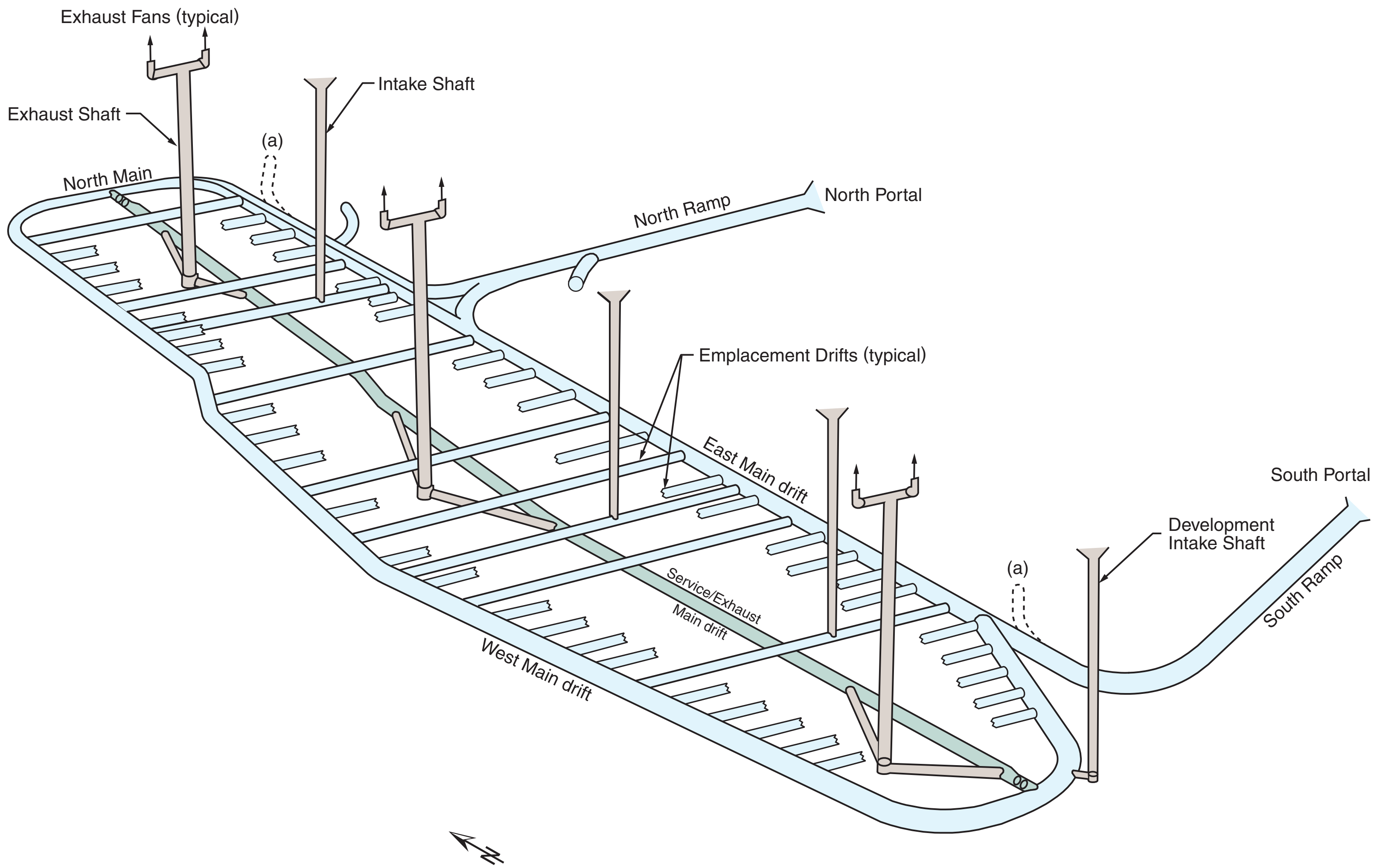


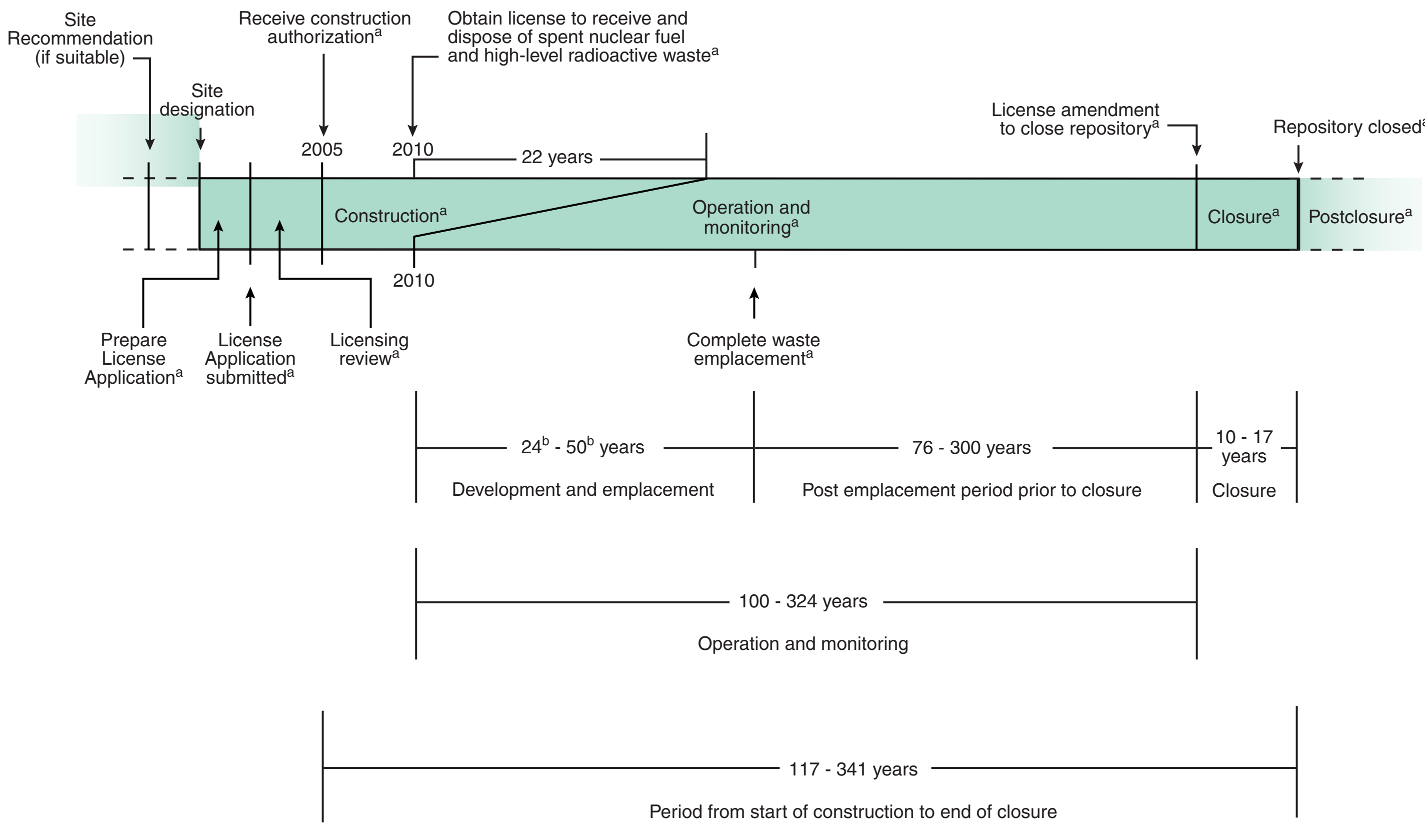
Figure S-7. Potential repository surface facilities site plan.



Note: (a) Potential connection to lower block

Drawing not to scale.

Figure S-8. Repository subsurface facility plan (higher-temperature repository operating mode).



a. If Yucca Mountain is approved.

b. Analysis without aging assumed that waste emplacement would occur over a 24-year period and analysis with aging assumed that waste emplacement with commercial spent nuclear fuel aging would occur over a 50-year period.

Figure S-9. Monitored geologic repository range of milestones used for analysis.

Construction. The construction of repository surface and subsurface facilities could begin after the receipt of construction authorization from the Nuclear Regulatory Commission. For analytical purposes, DOE assumed that construction would begin in 2005. The Department would build the repository surface facilities, main drifts, ventilation system, and initial emplacement drifts in about 5 years, from 2005 to 2010. Construction of the emplacement drifts would continue after emplacement began.

Surface facilities would receive, prepare, and package spent nuclear fuel and high-level radioactive waste for emplacement, and would support the construction of subsurface facilities. The primary surface facilities would be the *North Portal Operations Area* (including the *Waste Handling Building* and a *surface aging facility* if DOE employed aging of commercial spent nuclear fuel in conjunction with the lower-temperature repository operating mode), the *South Portal Development Area* (supporting subsurface facility development), and a 3-megawatt *solar power generating facility* that DOE would use to meet some of the electrical energy requirements of the repository.

Subsurface facilities would include the drifts developed during site characterization activities. During construction, additional underground excavation would occur. Excavation in the subsurface facilities would include gently sloping *access ramps* for the movement of construction and waste package vehicles, *main drifts* for the movement of construction and waste package vehicles, *emplacement drifts* for the placement of waste packages, *exhaust mains* to transfer air in the subsurface area, and *ventilation shafts* to transfer air between the surface and the subsurface. The higher-temperature repository operating mode would require three emplacement intake shafts, one development intake shaft, and three exhaust shafts to support the full emplacement of 70,000 MTHM. The lower-temperature repository operating mode could require three to seven emplacement intake shafts, one development intake shaft, and five to nine exhaust shafts. *Performance confirmation drifts* would contain instrumentation to monitor emplaced waste packages.

Operation and Monitoring. Repository operations would begin after the Nuclear Regulatory Commission granted a license to "receive and possess" spent nuclear fuel and high-level radioactive waste. For planning purposes, DOE assumed that the receipt and emplacement of these materials would begin in 2010. Based on a total emplacement of 70,000 MTHM at approximately 3,000 MTHM each year, waste emplacement would end after approximately 24 years.

Under the lower-temperature repository operating mode, DOE could place commercial spent nuclear fuel on a surface aging pad in Nuclear Regulatory Commission-licensed storage casks. This aging was assumed to occur during a 50-year period and would allow the heat generated by radioactive decay to be reduced before emplacing the waste packages into the repository.

The construction of emplacement drifts would continue for approximately 22 years during operation and monitoring. The repository design would enable simultaneous construction and emplacement operations, but it would physically separate construction or development activities from emplacement activities. Ventilation barriers would create airlocks to separate the emplacement and development sides of the repository, and the ventilation system would be designed to maintain the emplacement side at a lower pressure than the development side. This would ensure that no air leakage would occur from the emplacement side to the development side.

Monitoring and maintenance activities would begin with the first emplacement of waste packages and would continue until repository closure. The monitoring period, as defined for analytical purposes, would begin after the completion of emplacement. During the monitoring period, DOE would maintain the repository facilities, including the ventilation system and utilities (air, water, electric power) that would enable the continued monitoring and inspection of waste packages, continued investigations of long-term repository performance, and the retrieval of waste packages, if necessary. Immediately after

RETRIEVAL

Section 122 of the NWPA requires DOE to maintain the ability to retrieve emplaced materials. Because of this requirement, the EIS includes an analysis of the impacts of retrieval. Although the EIS analyzes it, DOE does not believe that retrieval would be necessary, and it is not part of the Proposed Action. DOE would maintain the ability to retrieve the spent nuclear fuel and high-level radioactive waste for at least 100 years and possibly for as long as 300 years in the event of a decision to retrieve the materials to protect public health and safety or the environment or to recover constituent parts of spent nuclear fuel.

the completion of emplacement, DOE would decontaminate and close the nuclear facilities on the surface to eliminate potential radioactive material hazards. However, the Department would maintain the Waste Handling Building for the possible retrieval of waste.

Closure. For the higher-temperature operating mode, the EIS analysis assumed repository closure would begin 100 years after the start of emplacement (76 years after the completion of emplacement) and would take 10 years. Repository closure for the lower-temperature operating mode would begin 125 to 300 years after the completion of emplacement and would take between 11 and 17 years, depending on the waste package spacing. The longer time required for the lower-temperature operating mode would ensure that the repository temperature would remain below boiling after closure.

Repository closure would occur after DOE received a license amendment from the Nuclear Regulatory Commission. Closure activities would include installing the titanium drip shields and closing the subsurface facilities, decommissioning the surface facilities, sealing openings into the mountain (access ramps, ventilation shafts, boreholes), performing reclamation activities at the site, and establishing institutional controls such as permanent monuments to mark and identify the area.

S.3.1.3 Transportation

DOE would transport spent nuclear fuel and high-level radioactive waste from commercial and DOE sites around the country to the Yucca Mountain site, either by rail or by truck. The Department analyzed two transportation scenarios (*mostly legal-weight truck* and *mostly rail*) that cover the reasonably foreseeable range of transportation impacts to human health and the environment.

The mostly legal-weight truck scenario assumes that DOE would transport most of the spent nuclear fuel and high-level radioactive waste to the repository by legal-weight truck. The trucks would travel from the 77 sites to the Yucca Mountain site primarily on the U.S. Interstate Highway system, as shown in Figure S-10. An exception to this scenario would be the naval spent nuclear fuel, which the Navy would transport from the Idaho National Engineering and Environmental Laboratory to Nevada by rail, as decided in the *Record of Decision for a Dry Storage Container System for the Management of Naval Spent Nuclear Fuel.*

The mostly rail scenario assumes that DOE and the Navy would transport most of the spent nuclear fuel and high-level radioactive waste to Nevada by rail, with the exception of material from commercial nuclear generating sites that initially would not have the capability to load

NEVADA TRANSPORTATION IMPLEMENTING ALTERNATIVES

Rail corridors
- Caliente
- Carlin
- Caliente-Chalk Mountain*
- Jean
- Valley Modified

Intermodal transfer station locations and heavy-haul truck routes
- Caliente
  - – Caliente route
  - – Caliente/Chalk Mountain route*
  - – Caliente/Las Vegas route
- Sloan/Jean (one route)
- Apex-Dry Lake (one route)

* Nonpreferred

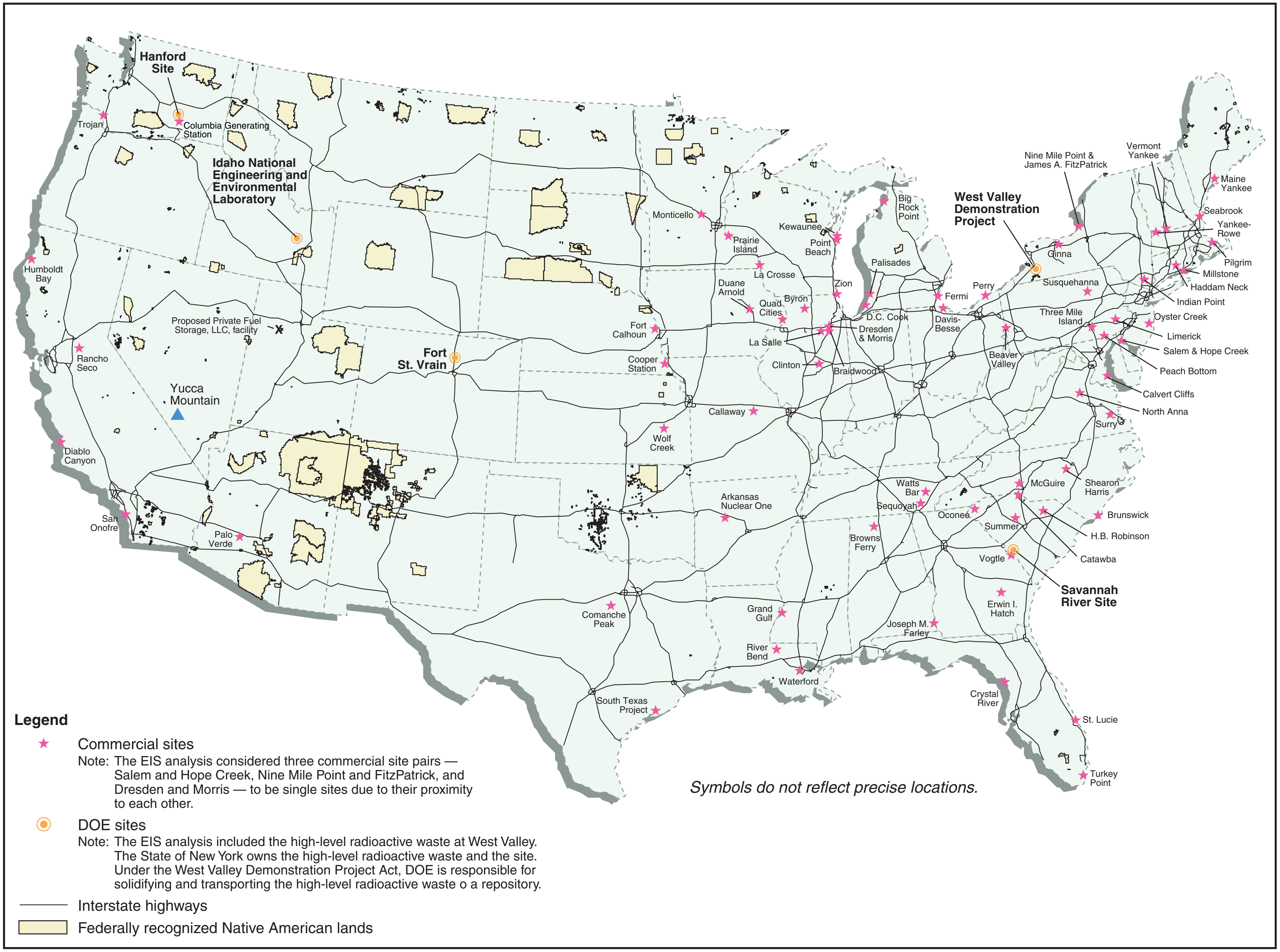


Figure S-10. Commercial and DOE sites and Yucca Mountain in relation to the U.S. Interstate Highway System.

DEFINITIONS FOR TRUCK TRANSPORTATION

Legal-weight trucks: trucks with a gross vehicle weight (both truck and cargo weight) of less than 36,300 kilograms (80,000 pounds), which is the loaded weight limit for commercial vehicles operated on public highways without special state-issued permits.

Heavy-haul trucks: overweight, overdimension vehicles that must have permits from state highway authorities to use public highways.

large-capacity rail shipping casks. Those sites would use legal-weight trucks to ship material to the repository. Commercial sites with the capability to load the rail shipping casks but that did not have rail access could use heavy-haul trucks or barges to ship spent nuclear fuel to the nearest rail line. Figure S-11 shows the commercial and DOE sites and Yucca Mountain in relation to the U.S. railroad system over which the railcars could travel.

In the State of Nevada, waste that traveled from the commercial and DOE sites by legal-weight truck would continue to the repository in the same manner. Figure S-12 shows the southern Nevada highways over which the legal-weight trucks could travel. Potential routes for legal-weight truck shipments in Nevada comply with U.S. Department of Transportation regulations (49 CFR 397.101) for selecting "preferred routes" and "delivery routes" for motor carrier shipments of Highway Route-Controlled Quantities of Radioactive Materials. Based on these regulations, those shipments would arrive in Nevada on Interstate-15, travel over the planned Las Vegas Beltway, and then proceed north on U.S. Highway 95 to Yucca Mountain. The State of Nevada could designate alternative routes as specified in 49 CFR 397.103.

REPOSITORY ANALYSIS

Repository Facilities and Operations

Packaging scenarios
- Mostly uncanistered fuel
- Mostly canistered fuel

Operating mode
- Higher-temperature
- Lower-temperature

Transportation Activities

National transportation scenarios
- Mostly legal-weight truck
- Mostly rail

Nevada transportation scenarios
- Mostly legal-weight truck
- Mostly rail with a new branch rail line (five corridors)
- Mostly rail with heavy-haul truck from a new intermodal transfer station (five routes)

At this time there is no rail access to the Yucca Mountain site. This means that material traveling by rail would have to continue to the repository on a new branch rail line or transfer to heavy-haul trucks at an intermodal (that is, from rail to truck) transfer station in Nevada and then travel on existing highways that could need to be upgraded. DOE is considering implementing alternatives for the construction of either a new branch rail line or an intermodal transfer station with associated highway improvements. The Department has identified five alternatives for rail corridors, each of which has alignment variations (Figure S-13), and three alternative locations for an intermodal transfer station and five associated highway routes for heavy-haul trucks (Figure S-14). Figure S-15 shows how the national and Nevada transportation scenarios relate.

S.3.1.4 Costs

DOE estimates that the total cost of the Proposed Action, including the transportation of spent nuclear fuel and high-level radioactive waste to the repository, would be about $42.8 billion to $57.3 billion (in 2001 dollars). These costs include:

- $31.5 billion to $43.1 billion for construction and operation of the repository.
- $4.3 billion for waste acceptance, storage, and transportation.

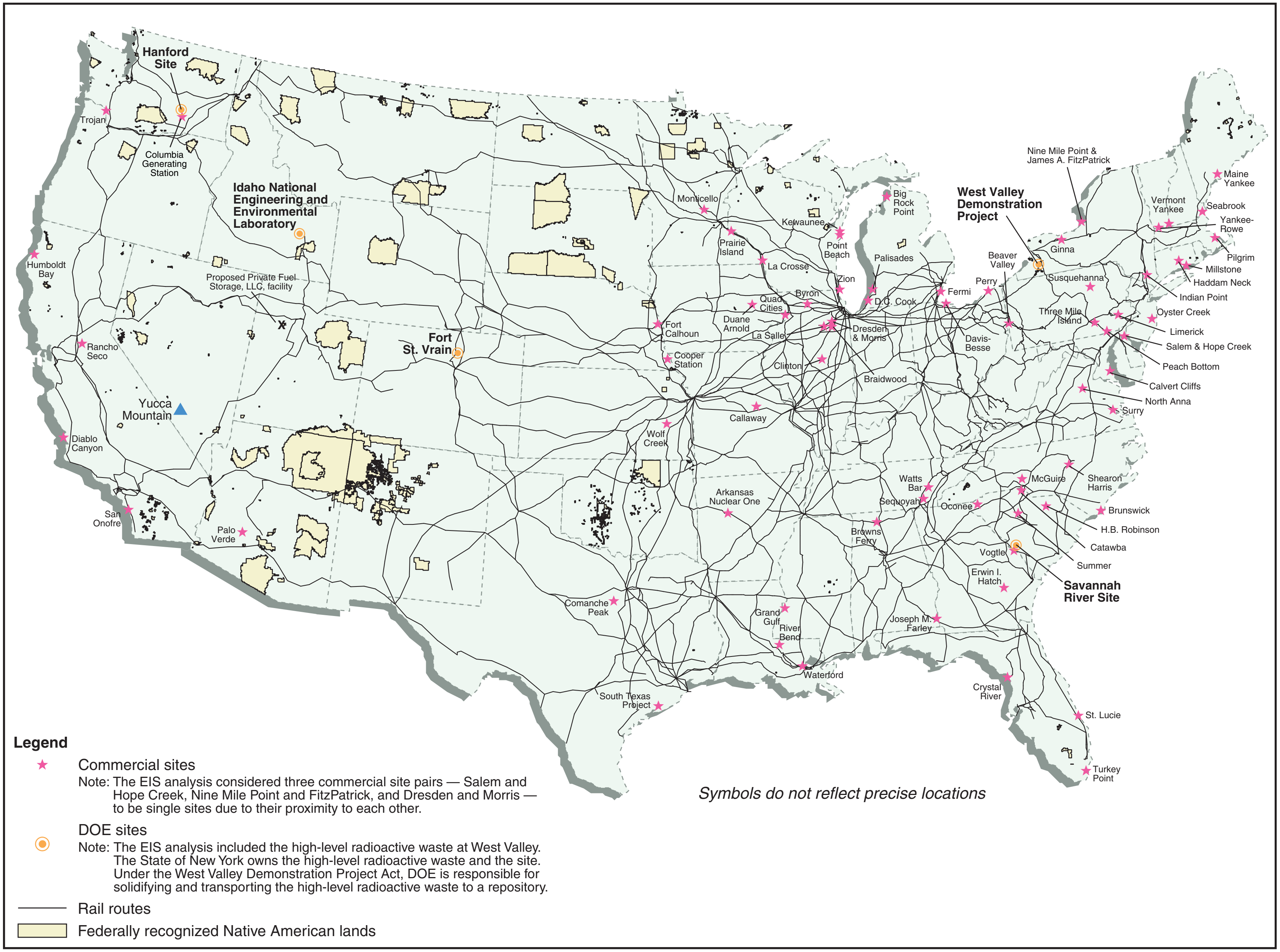


Figure S-11. Commercial and DOE sites and Yucca Mountain in relation to the U.S. railroad system.

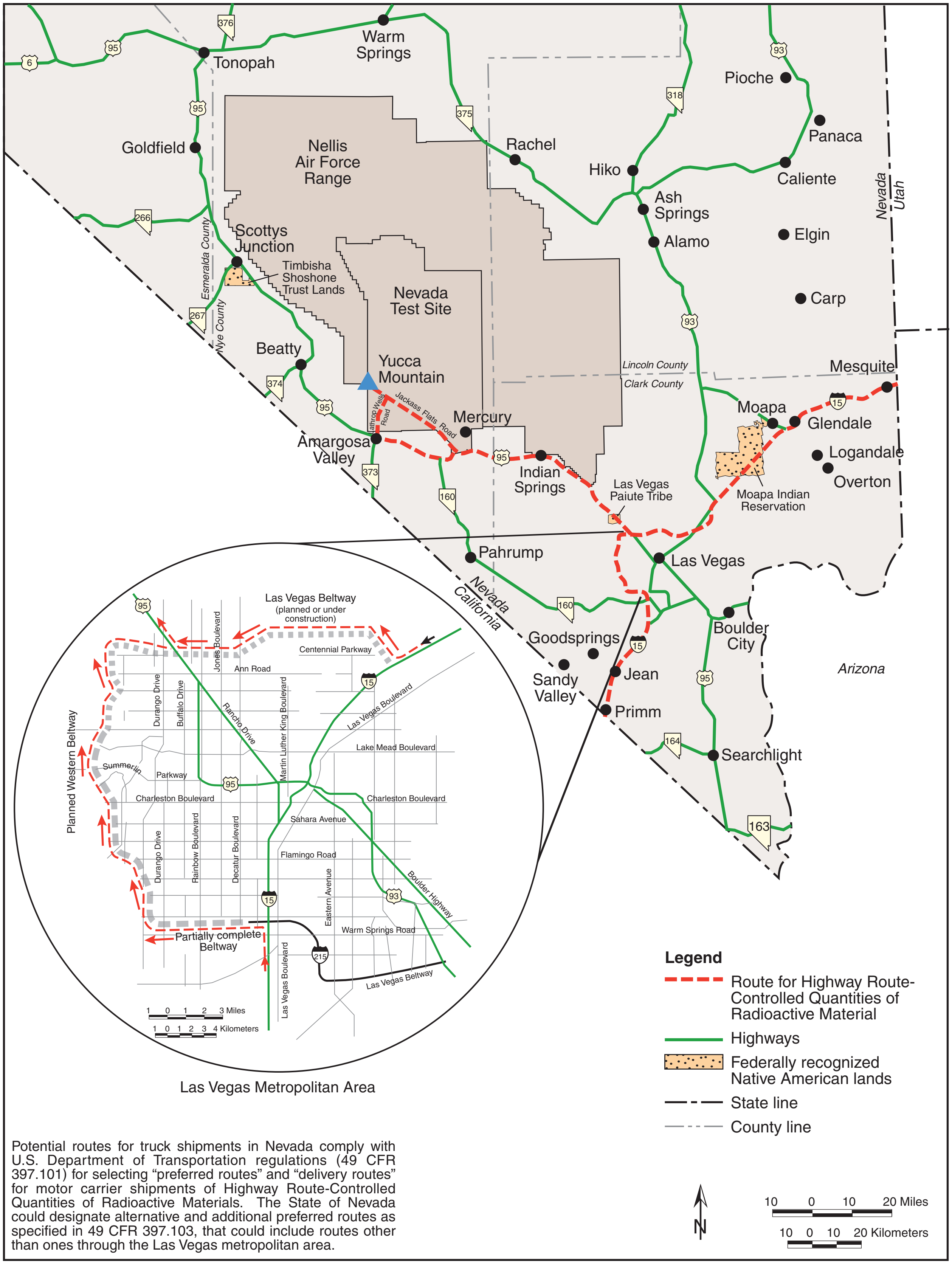


Figure S-12. Potential Nevada routes for legal-weight truck shipments of spent nuclear fuel and high-level radioactive waste to Yucca Mountain.

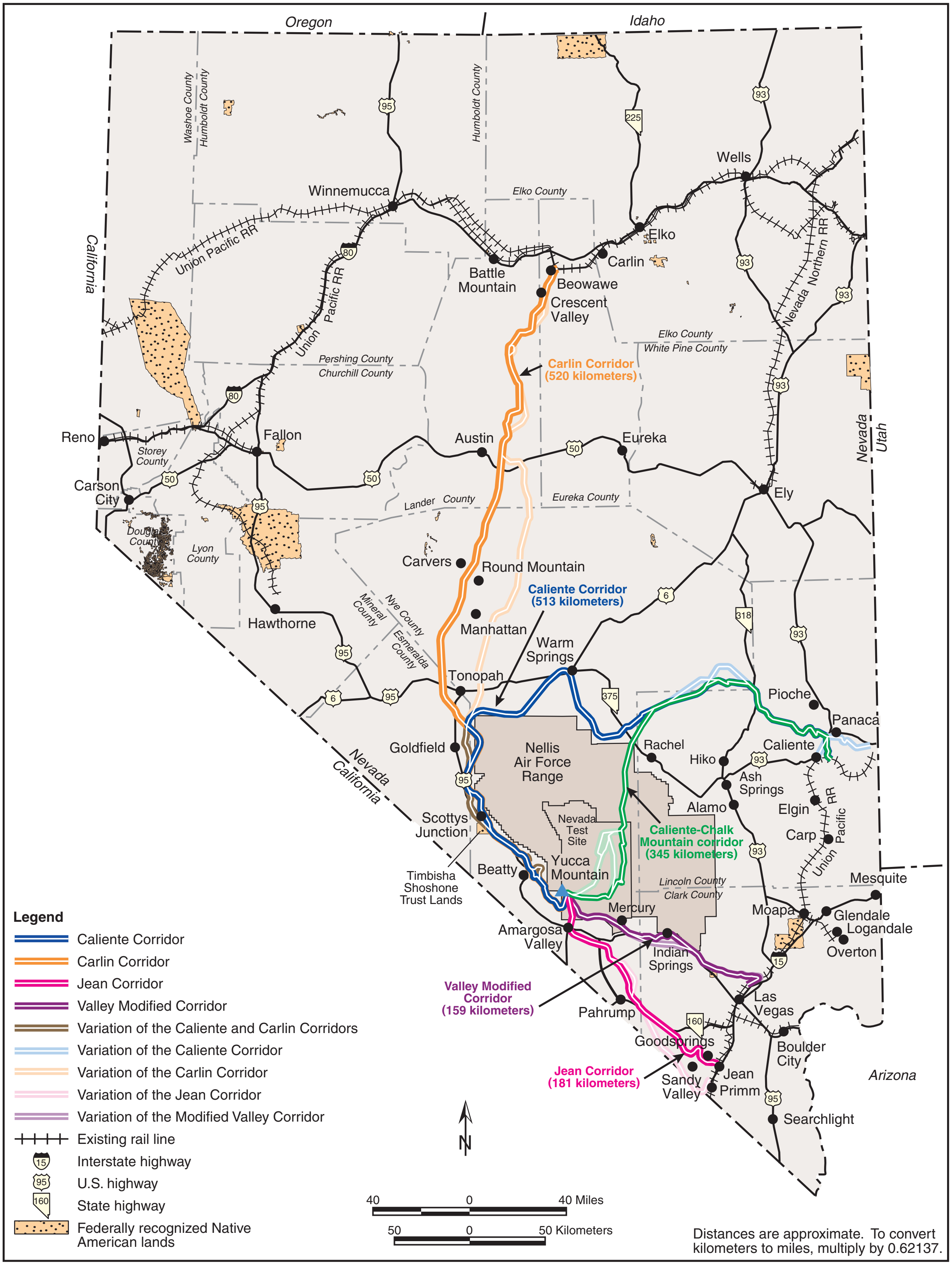
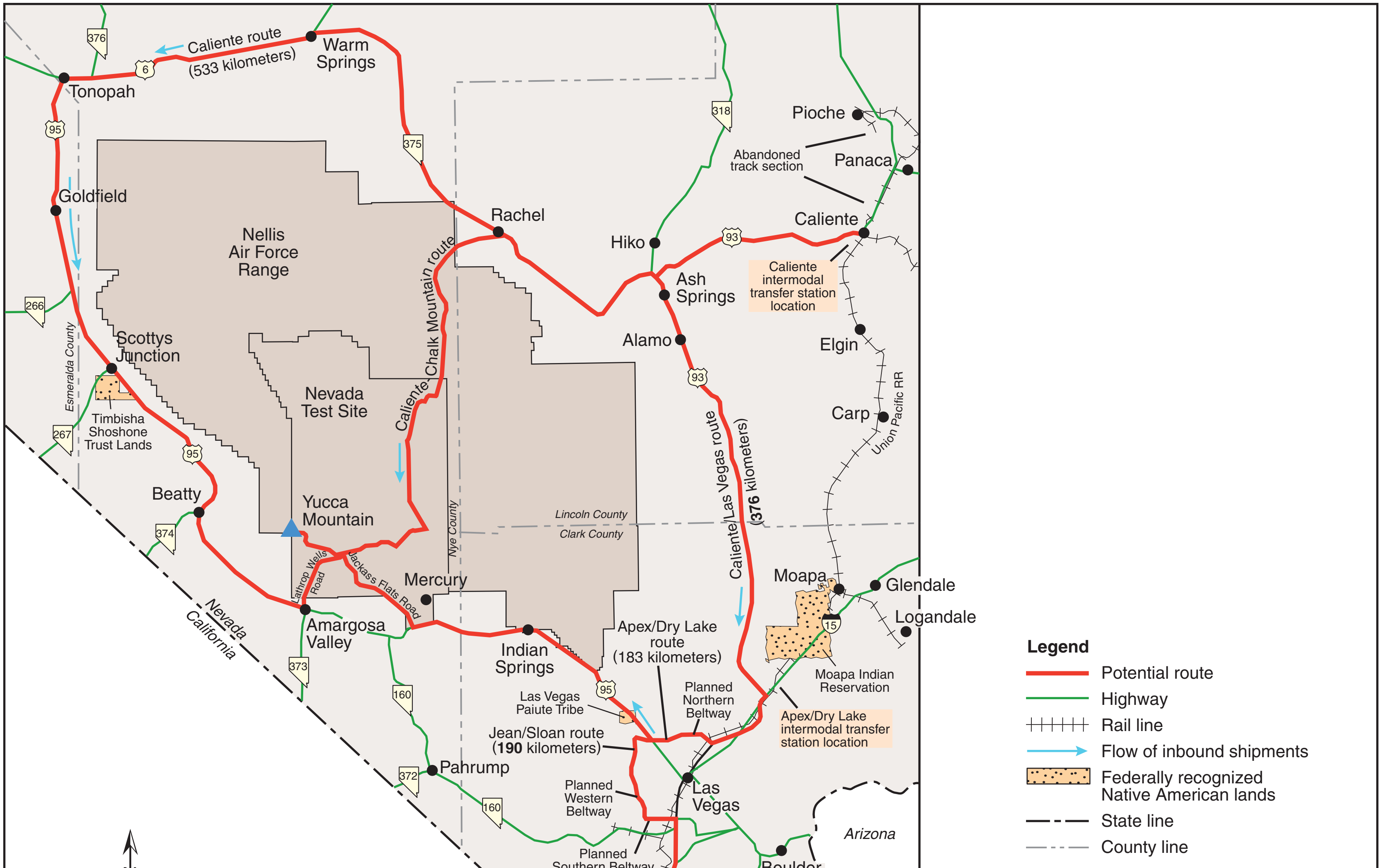


Figure S-13. Potential Nevada rail routes to Yucca Mountain.



Potential routes for truck shipments in Nevada comply with U.S. Department of Transportation regulations (49 CFR 397.101) for selecting "preferred routes" and "delivery routes" for motor carrier shipments of Highway Route-Controlled Quantities of Radioactive Materials. The State of Nevada could designate alternative and additional preferred routes as specified in 49 CFR 397.103, that could include routes other than ones through the Las Vegas metropolitan area.

Figure S-14. Potential intermodal transfer station locations and potential routes in Nevada for heavy-haul trucks.

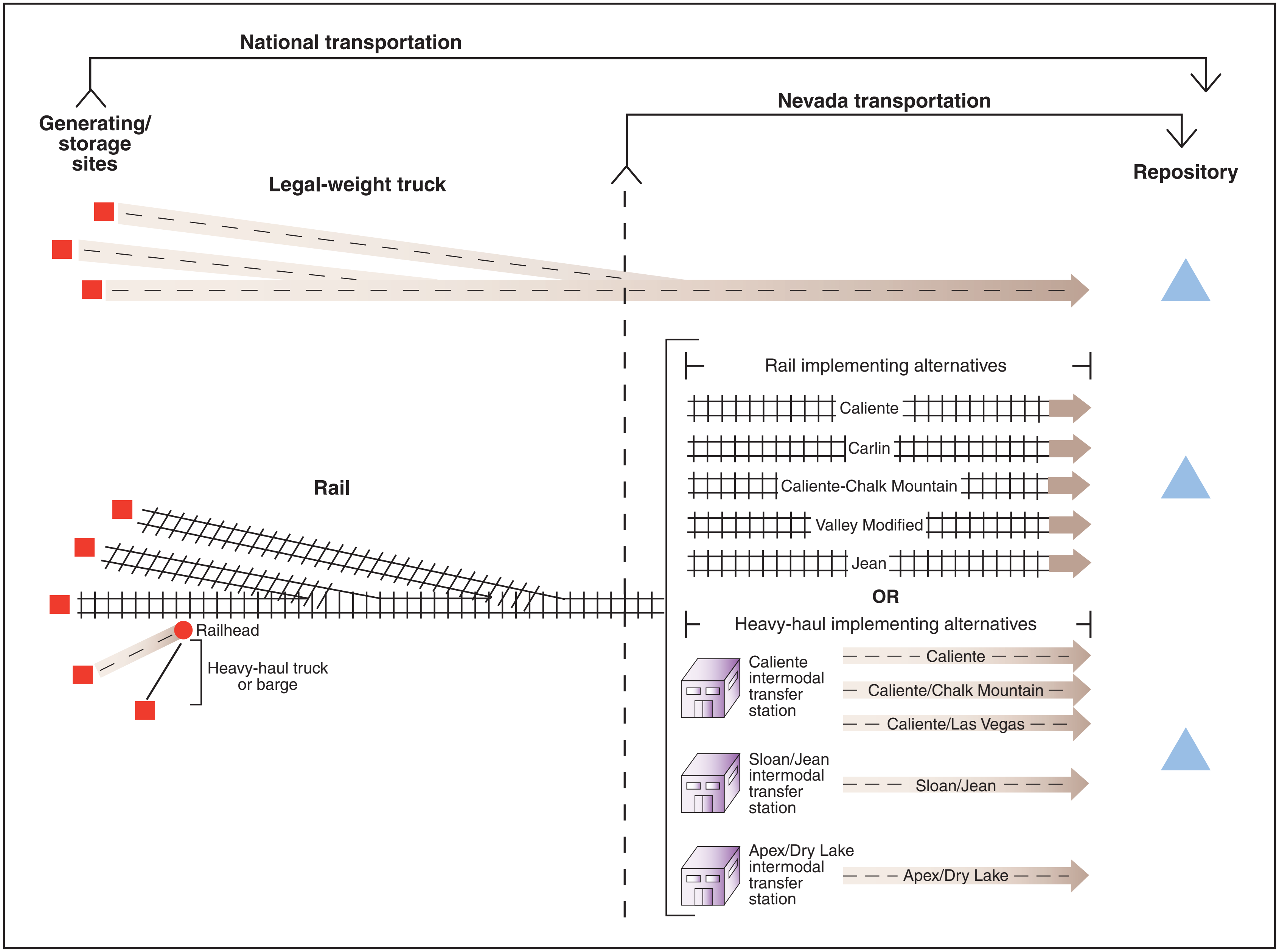


Figure S-15. Relationship of Nevada and national transportation.

- Up to $800 million for Nevada transportation, including construction of a potential branch rail line.

- $6.1 billion to $9.1 billion for program integration and institutional programs. These would include quality assurance, program management, costs associated with the Nuclear Regulatory Commission, Nuclear Waste Technical Review Board, and financial assistance for transportation planning.

The most recent estimates show that approximately 70 percent of the repository-related costs would be paid from the Nuclear Waste Fund (fees collected by nuclear utilities from ratepayers) and about 30 percent from taxpayer revenues (primarily to pay for disposal of DOE spent nuclear fuel and high-level radioactive waste).

S.3.2 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, DOE would end site characterization activities at Yucca Mountain and undertake site reclamation to mitigate adverse environmental impacts from those activities. The commercial nuclear power utilities and DOE would continue to store spent nuclear fuel and high-level radioactive waste. Because it would be highly speculative to attempt to predict future events, DOE decided to illustrate one set of possibilities by focusing its analysis of the No-Action Alternative on the potential impacts of two scenarios:

- Scenario 1 assumes that spent nuclear fuel and high-level radioactive waste would remain at the 72 commercial and 5 DOE sites under institutional control for at least 10,000 years.

- Scenario 2 assumes that spent nuclear fuel and high-level radioactive waste would remain at the 77 sites in perpetuity, but under institutional control for only about 100 years. This scenario assumes no effective institutional control of the stored spent nuclear fuel and high-level radioactive waste after 100 years.

INSTITUTIONAL CONTROL

Monitoring and maintenance of storage facilities to ensure that radiological releases to the environment and radiation doses to workers and the public remain within Federal limits and DOE Order requirements.

DOE recognizes that neither scenario would be likely if there were a decision not to develop a repository at Yucca Mountain; however, they are part of the EIS analysis to provide a basis for comparison to the Proposed Action. There are a number of possibilities that the Nation could pursue, including continued storage of the material at its current locations or at one or more centralized location(s); the study and selection of another location for a deep geologic repository; development of new technologies; or reconsideration of other disposal alternatives to deep geologic disposal. One such centralized storage possibility, the proposed Private Fuel Storage Facility for commercial spent nuclear fuel in Utah, is currently in the Nuclear Regulatory Commission licensing process. The Commission issued a Final EIS in January 2002, however, that document was unavailable for use during the preparation of this Final EIS. The Commission has yet to issue a decision on whether to grant a license. Under any future course that would include continued storage, both commercial and DOE sites have an obligation to continue managing the spent nuclear fuel and high-level radioactive waste in a manner that protects public health and safety and the environment.

S.3.2.1 Reclamation and Decommissioning at Yucca Mountain

Under the No-Action Alternative, site characterization activities would end at Yucca Mountain. DOE would start site decommissioning and reclamation. These activities would include the removal or shutdown of all surface and subsurface facilities, and the restoration of the lands disturbed during site characterization. DOE would fill and seal drill holes to meet Nevada requirements.

S.3.2.2 Continued Storage at Commercial and DOE Sites

Under the No-Action Alternative, the 72 commercial and 5 DOE sites would continue to store spent nuclear fuel and high-level radioactive waste. For purposes of analysis, the No-Action Alternative assumes that those sites would treat and package the materials, as necessary, for their safe onsite management. It also assumes that the amount of spent nuclear fuel and high-level radioactive waste stored would be the same as that shipped under the Proposed Action (70,000 MTHM).

The EIS analysis assumed that spent nuclear fuel and high-level radioactive waste would be placed in dry-storage canisters inside reinforced concrete storage modules. Both the canister and the concrete storage module would provide shielding against the radiation that the material would emit, although the concrete module would provide the primary shielding. The dry configuration would enable outside air to circulate and remove the heat of radioactive decay. As long as spent nuclear fuel, high-level radioactive waste, canisters, and storage modules were properly maintained, this would provide safe storage.

No-Action Scenario 1. Spent nuclear fuel and high-level radioactive waste would remain in dry storage at the commercial and DOE sites and would be under institutional control for at least 10,000 years. Institutional control at these facilities would ensure the protection of workers and the public in accordance with Federal regulations. For purposes of analysis, DOE assumed that the storage facilities would undergo one major repair during the first approximately 100 years, and complete replacement after the first 100 years and every 100 years thereafter.

No-Action Scenario 2. Spent nuclear fuel and high-level radioactive waste would remain in dry storage at the commercial and DOE sites and would be under institutional control for approximately 100 years (as in Scenario 1). This scenario, however, assumes no effective institutional control after 100 years, and that the storage facilities at 72 commercial and 5 DOE sites would begin to deteriorate after 100 years. The facilities would eventually release radioactive materials to the environment, contaminating the atmosphere, soil, surface water, and groundwater for the 10,000-year period analyzed.

The assumption for Scenario 2 that there would be no effective institutional control after approximately 100 years is based on a review of generally applicable requirements that discount altogether the consideration of institutional control after 100 years for purposes of conducting performance assessments [U.S. Environmental Protection Agency regulations (40 CFR Part 191); U.S. Nuclear Regulatory Commission regulations for disposal of low-level radioactive material (10 CFR Part 61); and the National Research Council report on standards for the proposed Yucca Mountain Repository]. Thus, in addition to its inherent conservatism, the assumption that no institutional control would be in place after 100 years provides a consistent analytical basis for comparing the No-Action Alternative and the Proposed Action.

If the institutional control period assumed for the analysis of the No-Action Scenario 2 was extended to 300 years, consistent with the lower-temperature repository operating mode of the Proposed Action, the short-term environmental impacts during the period would increase by as much as 3 times.

Figure S-16 shows conceptual timelines for activities at the commercial and DOE sites for Scenarios 1 and 2.

S.3.2.3 Costs

DOE estimates that the total cost of Scenario 1 or 2 for the first 100 years, including the decommissioning and reclamation of the Yucca Mountain site, would range from $55.7 billion to $61.3 billion (in 2001 dollars), depending on the need to replace the dry-storage canisters in addition to replacing the storage facilities during that time. If the institutional control period was extended to 300 years to be consistent

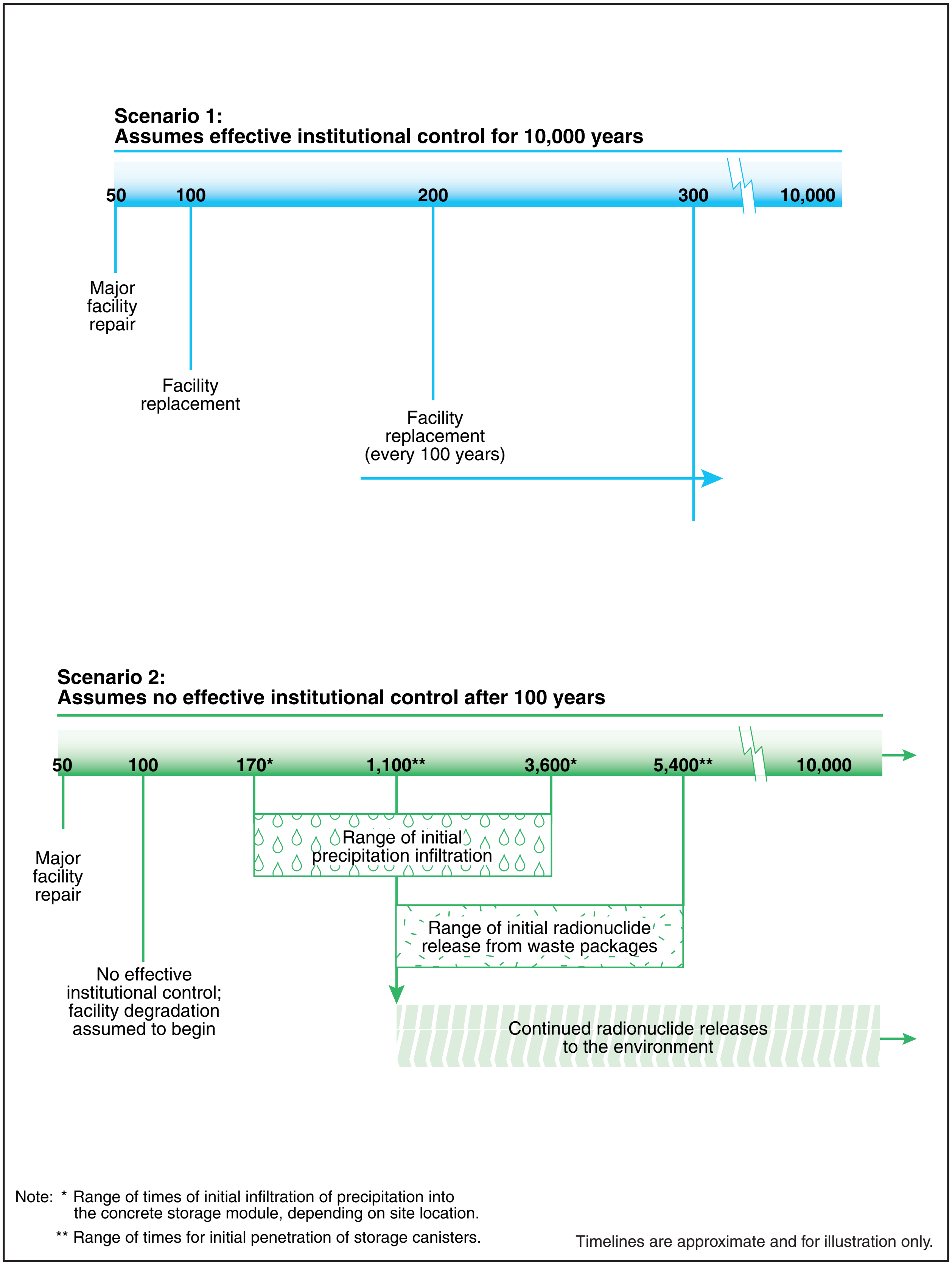


Figure S-16. Conceptual timelines for events at commercial and DOE sites for No-Action Scenarios 1 and 2.

with an extended monitoring period at the repository, the range values would triple to $167 billion to $184 billion (in 2001 dollars). The estimated cost for the remaining 9,700 to 9,900 years of Scenario 1 would range from $519 million to $572 million per year. There would be no costs under Scenario 2 after the first 100 years because that scenario assumes no effective institutional control after that time.

S.4 Issues Raised by the Public

S.4.1 Issues Raised in Public Scoping

DOE solicited written comments and held 15 public scoping meetings across the country between August 29 and October 24, 1995, to enable interested parties to present comments on the scope of this EIS.

During the public scoping process, a number of commenters asked that the EIS discuss the history of the Yucca Mountain site characterization program and requirements of the NWPA, address DOE's responsibility to begin accepting waste in 1998, describe the potential decisions that the EIS would support, and examine activities other than construction, operation and monitoring, and closure of a repository at Yucca Mountain. Other comments raised during public scoping addressed the consistency of the proposed repository with existing land uses, effects of earthquakes and volcanism, health and safety impacts, long-term impacts, and sabotage. In response to the public's input, DOE included discussions and analyses of these issues in the EIS. DOE also received comments noting that the Nation will have more than 70,000 MTHM of spent nuclear fuel and high-level radioactive waste, although the NWPA directs that the maximum amount allowed for repository disposal is 70,000 MTHM of these materials until a second repository is in operation. Commenters encouraged DOE to evaluate the disposal of the entire anticipated inventory of spent nuclear fuel and high-level radioactive waste and other waste types that might also require permanent isolation. For this reason, the EIS analyzes cumulative environmental impacts that could occur from the disposal at Yucca Mountain of the country's total projected inventory of spent nuclear fuel and high-level radioactive waste, as well as Greater-Than-Class-C and Special-Performance-Assessment-Required wastes. In response to other public scoping comments, DOE added an additional transportation corridor and route in Nevada to the analysis.

Many other public scoping comments presented views and concerns not related to the scope or content of the Proposed Action. Examples of these comments include statements in general support of or opposition to a repository at Yucca Mountain, geologic repositories in general, and nuclear power; lack of public confidence in the Yucca Mountain program; perceived inequities and political aspects of the siting process by which Congress selected Yucca Mountain for further study; the constitutional basis for waste disposal in Nevada; legal issues involving Native American land claims and treaty rights; and unrelated DOE activities. DOE considered and recorded these concerns, but has not included analyses of these issues in the EIS.

S.4.2 Issues Raised on the Draft EIS and the Supplement to the Draft EIS

During the public comment process for the Draft EIS and the Supplement to the Draft EIS, commenters raised a variety of key issues. DOE identified issues as "key" based on factors such as:

- The extent to which an issue concerned fundamental aspects of the Proposed Action
- The nature of the comments as characterized by the commenter
- The extent to which DOE modified the EIS in response to the issue
- The number of comments received on a particular issue